91600
new 82-10

COMPLIMENTARY COPY
Please Credit Ontario Hydro Research If
Reproduced in Whole or in Part

ontario hydro
research division

To Public Works Canada
P.O. Box 668, Station B
451 Talbot Street
London, Ontario N6A 4Y4

Attn: Mr. T.E. Douglas

EVALUATION OF ROCK SAMPLES FROM McKEAN QUARRY

R. Koopmans

Three rock samples from McKean Quarry were subjected to 313 cycles of freeze/thaw testing. Periodic examinations and ultrasonic testing were undertaken during the testing period. In general, the specimens experienced no apparent deleterious effects as a result of this testing program. Minor sample fracturing was noted however, subsequent to a period of drying.

INTRODUCTION

Three samples of dolomite from McKean Quarry (located approximately 15 kilometers south of Collingwood) were submitted by Mr. T.E. Douglas of Public Works Canada for freeze/thaw testing on October 31, 1985. These specimens were tested to determine their suitability for use in the construction of a wharf in Goderich, Ontario.

PROCEDURE

The samples were numbered according to Ontario Hydro's Rock Sciences Section identification system. The first sample (P-3737-1) was a light grey and buff coloured porous fossiliferous dolomite. The second sample (P-3737-2) was a light grey porous fossiliferous dolomite while the third sample (P-3737-3) was a darker grey porous fossiliferous dolomite. All three samples were cut into blocks having approximate dimensions of 13 cm x 10 cm x 7 cm (5 in x 4 in x 3 in) and then photographed on both sides prior to freeze/thaw testing (Figures 1 to 6).

The bulk relative density, the apparent relative density, the absorption and the effective porosity were determined for each sample. This information is provided in Table 1. All three

samples were subjected to 313 freeze/thaw cycles. Periodically, pulse velocities and weights were recorded to determine whether or not specimen breakdown was occurring. Tables 2.1 to 2.3 show the results of the freeze/thaw testing program, which commenced on November 4, 1985 and was completed on December 18, 1985.

DISCUSSION

The absorption values for samples P-3737-2 and P-3737-3 seem to be somewhat on the high side as compared to similar rock types in different areas of Ontario (Carmichael and Koopmans, 1980). This fact, however, did not seem to have any noticeable deleterious effect as a result of being exposed to 313 freeze/thaw cycles. In summary, specimen P-3737-1 showed no significant changes after a slight initial weight gain. Sample P-3737-2 experienced a small weight loss after a rock piece broke off between 114 and 148 cycles. Sample P-3737-3 showed a progressive weight gain from 2350 gm to 2370 gm. An examination of all three specimens immediately subsequent to freeze/thaw testing revealed no noticeable fractures. It should be noted that all samples were maintained in a moist environment throughout the course of the testing program.

A few fractures were noted after a week or two of drying when left at room temperature. Sample P-3737-1 experienced a crack which could be traced half way around the specimen. Sample P-3737-2 showed fractures and some fragmentation around the edges, especially in areas continuing fossiliferous layers. Sample P-3737-3 also showed some fracturing at the edges but not to the same degree as that found in sample P-3737-2. Sample trimmings, which were kept untouched at room temperature and not subjected to freeze/thaw testing were also noted to have experienced minor fracturing and fragmentation.

CONCLUSION

All three samples from McKean Quarry performed well under 313 cycles of freeze/thaw testing. Minor distress was noted, however, on both the prepared samples and their trimmings subsequent to a drying period. Based on these tests and observations, sample P-3737-1 exhibited the best overall performance, followed next by sample P-3737-3 and then by sample P-3737-2.

It should be emphasized that this study was basically undertaken to determine the freeze/thaw effects of the submitted samples and did not examine their durability under wetting/drying conditions.

Therefore, the effects of wetting/drying on these samples and their respective parental rocks may require further investigation.

Approved by:

T.W. Klym
Manager
Civil Research Dept

Submitted by:

P. Koopmans
Geotechnical Engineer
Rock Sciences Section

Reviewed by:

A.T. Jakubick
A/Supervising Engineer
Rock Sciences Section

RK:EJ

REFERENCE

Carmichael, T.J. and P. Koopmans, Evaluation of Ontario Shoreline Protection Materials, Canadian Coastal Conference, Burlington, Ontario, April 22-24, 1980, pp 248-262.

TABLE 1

Bulk and Apparent Relative Density, Absorption and Effective Porosity

Sample No	Bulk Relative Density	Apparent Relative Density	Absorption (%)	Effective Porosity (%)
P-3737-1	2.65	2.73	1.76	4.57
P-3737-2	2.52	2.68	4.09	9.91
P-3737-3	2.59	2.68	2.27	5.74

TABLE 2.1

FREEZE/THAW TESTING RESULTS - SAMPLE P-3737-1

Date (1985)	Cycles	Pulse Velocity [m/sec]	Weight [g]	Weight Change (%)	Comments
Nov 4	0	5290	2310	-	
Nov 6	15	5290	2315	+0.216	
Nov 8	30	5290	2315	+0.216	
Nov 11	51	4880	2315	+0.216	
Nov 13	65	5080	2315	+0.216	
Nov 15	80	5080	2315	+0.216	
Nov 20	114	5080	2315	+0.216	
Nov 25	148	5080	2315	+0.216	
Nov 29	177	5080	2315	+0.216	
Dec 4	213	5080	2315	+0.216	
Dec 9	249	5290	2315	+0.216	
Dec 13	277	5290	2315	+0.216	
Dec 18	313	5290	2315	+0.216	

TABLE 2.2

FREEZE/THAW TESTING RESULTS - SAMPLE P-3737-2

Date (1985)	Cycles	Pulse Velocity [m/sec]	Weight [g]	Weight Change (%)	Comments
Nov 4	0	4710	2450	-	
Nov 6	15	4710	2455	+.204	
Nov 8	30	4710	2460	+.408	
Nov 11	51	4890	2460	+.408	
Nov 13	65	4550	2460	+.408	
Nov 15	80	4710	2460	+.408	
Nov 20	114	4710	2460	+.408	
Nov 25	148	4890	2445	-.204	- small piece broke off
Nov 29	177	4890	2445	-.204	
Dec 4	213	4890	2445	-.204	
Dec 9	249	4890	2445	-.204	
Dec 13	277	4890	2445	-.204	
Dec 18	313	4890	2445	-.204	

TABLE 2.3

FREEZE/THAW TESTING RESULTS - SAMPLE P-3737-3

Date (1985)	Cycles	Pulse Velocity [m/sec]	Weight [g]	Weight Change (%)	Comments
Nov 4	0	3850	2350	-	
Nov 6	15	3850	2355	+0.213	
Nov 8	30	3850	2360	+0.426	
Nov 11	51	3740	2360	+0.426	
Nov 13	65	3630	2360	+0.426	
Nov 15	80	3740	2360	+0.426	
Nov 20	114	3740	2360	+0.426	
Nov 25	148	3740	2360	+0.426	
Nov 29	177	3740	2360	+0.426	
Dec 4	213	3850	2360	+0.426	
Dec 9	249	3850	2360	+0.638	
Dec 13	277	3850	2365	+0.638	
Dec 18	313	3850	2370	+0.851	

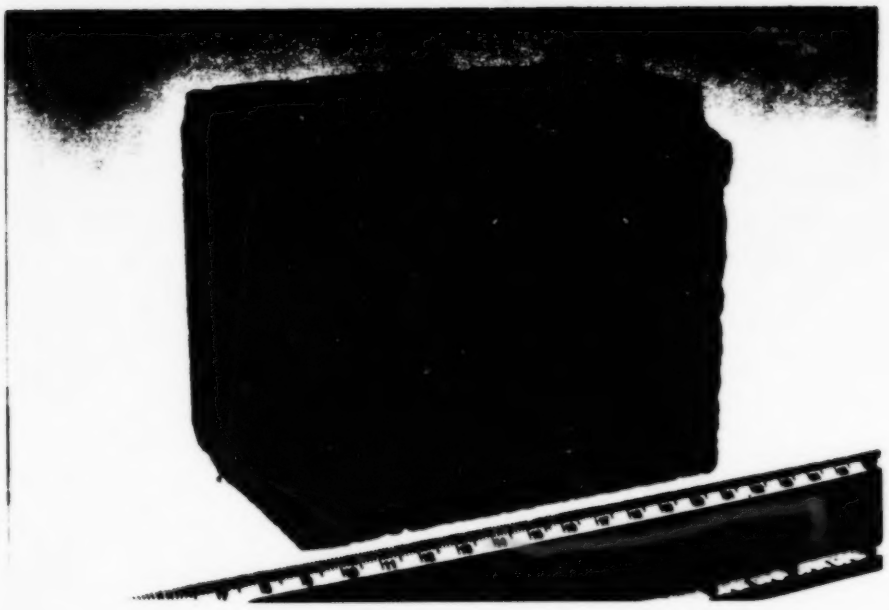

FIGURE 1

FRONT VIEW OF SAMPLE P-3737-1

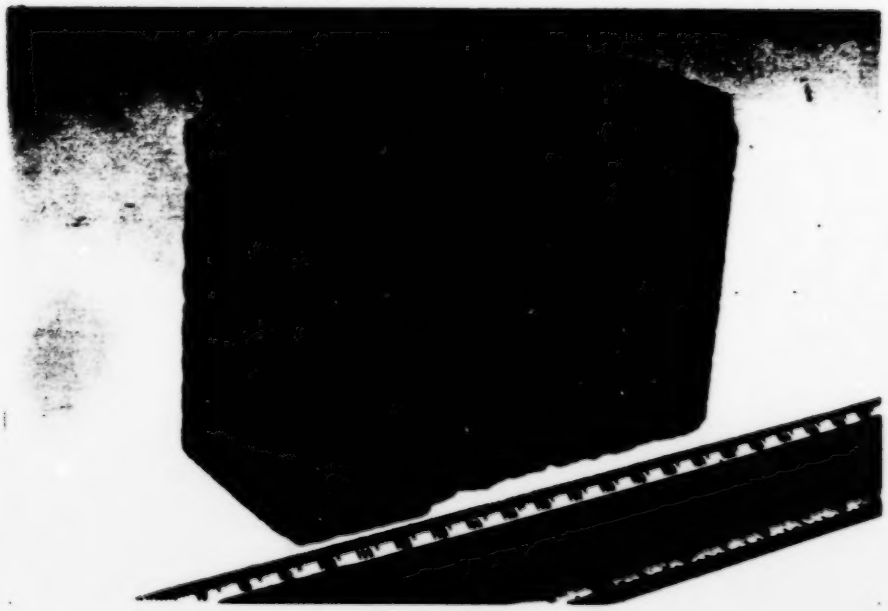

FIGURE 2

REAR VIEW OF SAMPLE P-3737-1

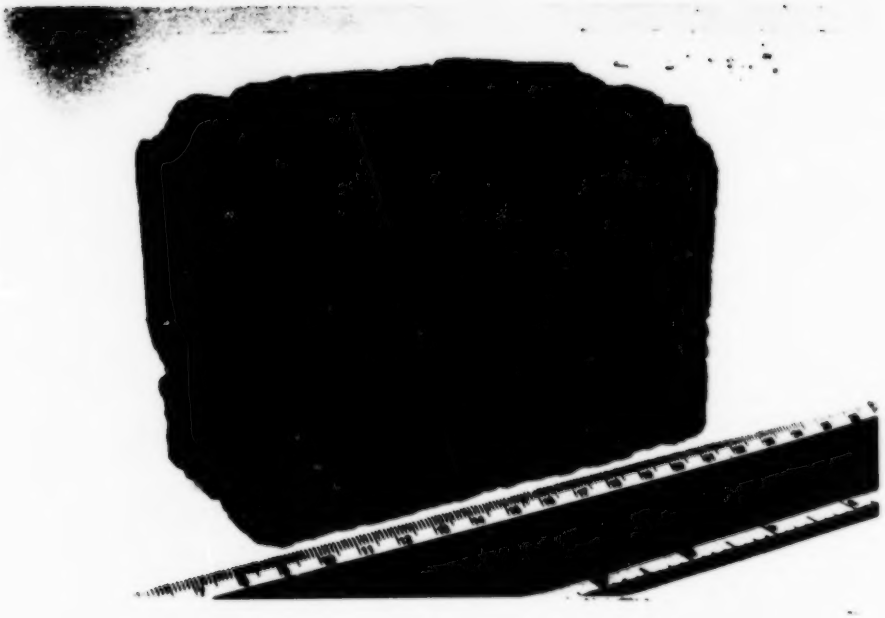

FIGURE 3

FRONT VIEW OF SAMPLE P-3737-2

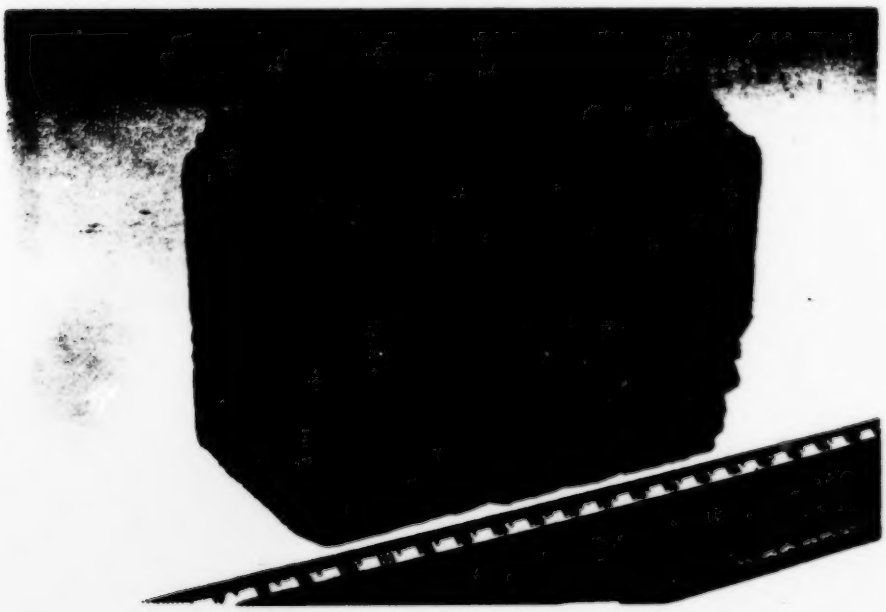

FIGURE 4

REAR VIEW OF SAMPLE P-3737-2

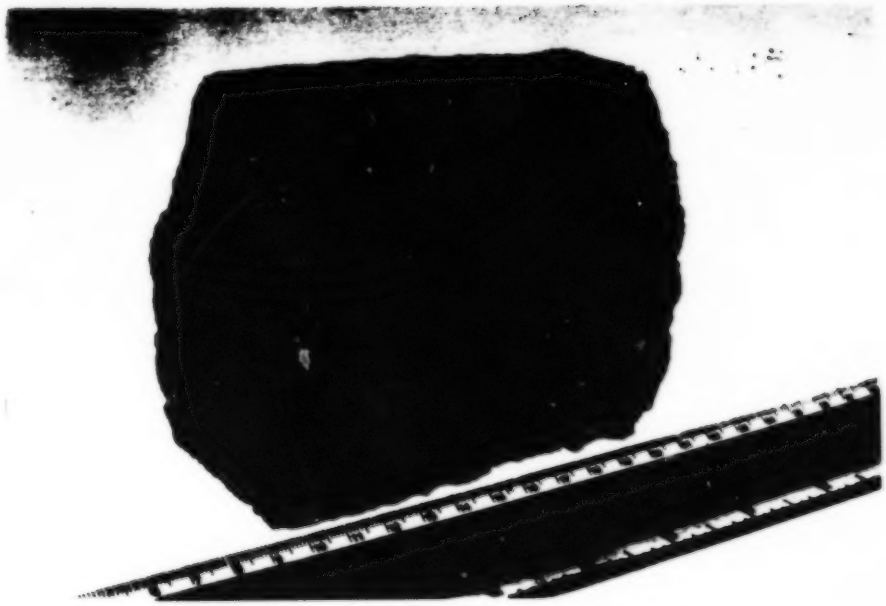

FIGURE 5

FRONT VIEW OF SAMPLE P-3737-3

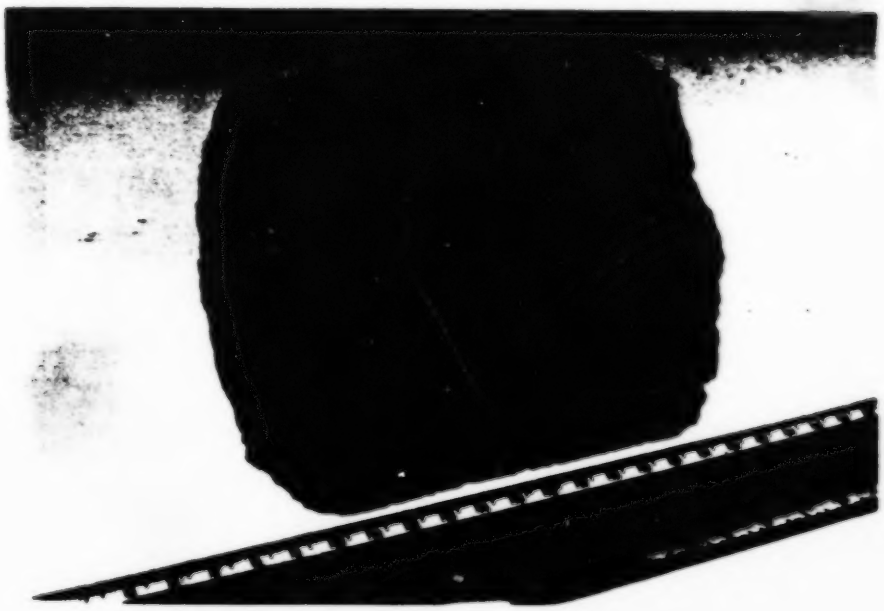

FIGURE 6

FRONT VIEW OF SAMPLE P-3737-3